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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/710,732	07/30/2004	Ko-Hsing Chang	13041-US-PA	4731

31561 7590 04/06/2007  
JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE  
7 FLOOR-1, NO. 100  
ROOSEVELT ROAD, SECTION 2  
TAIPEI, 100  
TAIWAN

EXAMINER

HARRISON, MONICA D

ART UNIT PAPER NUMBER

2813

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/06/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/710,732	<b>Applicant(s)</b> CHANG ET AL.	
	<b>Examiner</b> Monica D. Harrison	<b>Art Unit</b> 2813	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 March 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Allowable Subject Matter***

1. Applicant is advised that the Notice of Allowance mailed 12/20/06 is vacated. If the issue fee has already been paid, applicant may request a refund or request that the fee be credited to a deposit account. However, applicant may wait until the application is either found allowable or held abandoned. If allowed, upon receipt of a new Notice of Allowance, applicant may request that the previously submitted issue fee be applied. If abandoned, applicant may request refund or credit to a specified Deposit Account.

2. The indicated allowability of claims 1-20 is withdrawn in view of the newly discovered reference(s) to Rhodes (6,611,037 B1), Czubytyj et al (5,180,690), and Nishizawa et al (4,866,500). Rejections based on the newly cited reference(s) follow.

### ***Specification***

3. 35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: The examiner perceives the well region and the substrate to be two separate entities. In paragraph 0026, applicant states that well region 402 is formed by a mask layer over the substrate 400 to define a well region and an ion implantation process to form the well region in the substrate. In the claims, the applicant discloses wherein the doped layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area (claim 1) and forming a buffer layer over the substrate wherein the buffer layer covers the interior walls of the

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trenches and the surface of the substrate within the photosensitive area (claim 16). Applicant is displaying that the buffer and the doped layer are above the substrate (Figure 10) however, they do not cover the surface of the substrate. They cover the surface of the well.

### *Drawings*

4. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, wherein the doped layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area (claim 1) and forming a buffer layer over the substrate wherein the buffer layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area (claim 16) must be shown or the feature(s) canceled from the claim(s). Again, these layers cover the surface of the well, not the surface of the substrate. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will

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be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 112***

5. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In applicants description of the claimed invention, applicant states that the doped layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area (claim 1) and forming a buffer layer over the substrate wherein the buffer layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area (claim 16). However, in applicant's drawings (Figure 10), the doped layer 412 and buffer layer 410 are formed within the well region, not the substrate. In paragraph 0026, applicant states that well region 402 is formed by a mask layer over the substrate 400 to define a well region and an ion implantation process to form the well region in the substrate. The examiner perceives the well region and the substrate to be two separate entities.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 4, 9 and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Rhodes (6,611,037 B1).

6. Regarding claim 1, Rhodes discloses a method of fabricating a photodiode, comprising the steps of: providing a substrate (Figure 6, reference 316); forming a well region of a first conductive type in the substrate (Figure 6, reference 311); forming an isolation structure in the substrate to define a photosensitive area on the substrate (Figure 6, reference 350); forming a plurality of trenches in the well region of the substrate within the photosensitive area (Figure 6, reference 324); and forming a doped layer of a second conductive type over the substrate, wherein the doped layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area (Figure 6, reference 326).

7. Regarding claim 4, Rhodes discloses wherein the first conductive type is P-type (Figure 6, reference 316) and the second conductive type is N- type (Figure 6, reference 311) (column 8, lines 43-53).

8. Regarding claim 9, Rhodes discloses forming a buffer layer over the substrate covering the interior walls of the trenches as well as the surface of the substrate within the photosensitive area after forming the trenches in the substrate within the photosensitive area (Figure 11, reference 328).

9. Regarding claim 10, Rhodes discloses wherein the step of forming the buffer layer comprises performing a chemical vapor deposition process (column 10, lines 33-37).

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rhodes (6,611,037 B1) in view of Czubytyj et al (5,180,690).

10. Rhodes discloses all above claimed subject matter except after forming the doped layer over the substrate, performing an annealing operation (claims 2 and 12).

Czubytyj et al discloses forming the doped layer over the substrate, performing an annealing operation (column 6, lines 60-68 thru column 7, lines 1-6).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Rhodes with the teachings of Czubytyj et al for the purpose of annealing the dopant layer in order to activate the doped layer of amorphous semiconductor alloy material, while incorporating the dopant element into the matrix of the semiconductor alloy material. The dopant grading continuum is thus critical since annealing causes crystallites possessing the graded profile found in the amorphous material to grow. Polycrystalline material having the graded profile will therefore not possess the abrupt interfaces of prior art devices, and therefore have superior electronic qualities.

Claims 5-8, 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rhodes (6,611,037 B1) in view of Nishizawa et al (4,866,500).

11. Rhodes discloses all above claimed subject matter except wherein the first conductive type is N-type and the second conductive type is P-type (claim 5), wherein the step of forming the doped layer comprises performing a chemical vapor deposition process (claim 6), wherein material constituting the doped layer is selected from the group consisting of doped

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polysilicon and doped epitaxial silicon (claims 7 and 11) nor wherein the doped layer completely fills the trenches (claims 8 and 15).

Nishizawa et al discloses wherein the first conductive type is N-type (Figure 1D, reference 103) and the second conductive type is P-type (Figure 1D, reference 113), wherein the step of forming the doped layer comprises performing a chemical vapor deposition process (Figure 2F, reference 213), wherein material constituting the doped layer is selected from the group consisting of doped polysilicon and doped epitaxial silicon (Figure 2F, reference 213; polysilicon) nor wherein the doped layer completely fills the trenches (Figure 2F, reference 213).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Rhodes with the teachings of Nishizawa et al, for the purpose of light-triggered static induction thyristor and static induction phototransistors .

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica D. Harrison whose telephone number is 571-272-1959. The examiner can normally be reached on M-F 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Monica D. Harrison  
AU 2813

mdh  
March 21, 2007

  
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